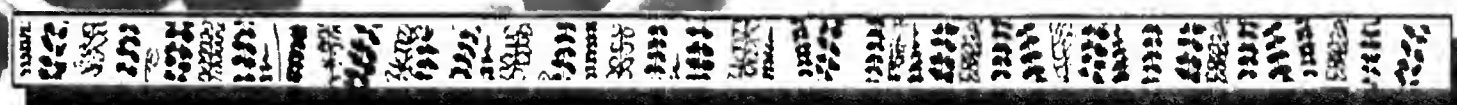




# Hardy Fern Foundation Quarterly



Spring 2006

## THE HARDY FERN FOUNDATION

P.O. Box 3797

Federal Way, WA 98036-3797

Web site: [www.hardyferns.org](http://www.hardyferns.org)

**The Hardy Fern Foundation** was founded in 1989 to establish a comprehensive collection of the world's hardy ferns for display, testing, evaluation, public education and introduction to the gardening and horticultural community. Many rare and unusual species, hybrids and varieties are being propagated from spores and tested in selected environments for their different degrees of hardiness and ornamental garden value.

The primary fern display and test garden is located at, and in conjunction with, The Rhododendron Species Botanical Garden at the Weyerhaeuser Corporate Headquarters, in Federal Way, Washington.

Satellite fern gardens are at the Stephen Austin Arboretum, Nacogdoches, Texas, Birmingham Botanical Gardens, Birmingham, Alabama, California State University at Sacramento, Sacramento, California, Coastal Maine Botanical Garden, Boothbay, Maine, Dallas Arboretum, Dallas, Texas, Denver Botanic Gardens, Denver, Colorado, Georgeson Botanical Garden, University of Alaska, Fairbanks, Alaska, Harry P. Leu Garden, Orlando, Florida, Inniswood Metro Gardens, Columbus, Ohio, Lewis Ginter Botanical Garden, Richmond, Virginia, New York Botanical Garden, Bronx, New York, and Strybing Arboretum, San Francisco, California.

The fern display gardens are at Bainbridge Island Library, Bainbridge Island, WA, Lakewold, Tacoma, Washington, Les Jardins de Metis, Quebec, Canada, University of Northern Colorado, Greeley, Colorado, and Whitehall Historic Home and Garden, Louisville, KY.

Hardy Fern Foundation members participate in a spore exchange, receive a quarterly newsletter and have first access to ferns as they are ready for distribution.

*Cover Design by Willanna Bradner*

**HARDY FERN FOUNDATION QUARTERLY**

# THE HARDY FERN FOUNDATION QUARTERLY

Volume 16 No. 2 Editor-Sue Olsen

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## **The Spore Exchange Needs You!**

Please send your spores to our Spore Exchange Director:

Katie Burki  
501 S. 54th St.  
Tacoma, WA 98408

## President's Message - Spring 2006

Greetings. It has been a relatively cool and gray late winter and early spring here in the Pacific Northwest. We are waiting for our first sixty degree day. As I look over my notes from last year's spring message, I see that ferns are a week or two latter in emerging this year as compared to last year. Maybe, because of the February cold spell that brought temperatures to the mid teens, cold for us in the PNW, ferns are reluctant to unfurl until assured that warmer days lie ahead.

The HFF educational booth at the Northwest Flower and Garden Show was laid out very nicely by curator Michelle Bundy and her assistant Jo Laskowski. One area of the booth showcased ferns that do well in sun and another area showcased ferns that do best in shade. Both of these displays generated a lot of interest from show visitors. On the center table was a beautifully arranged picture board that chronologically depicted the making of the Fern Habitat Garden that HFF installed three years ago at the Washington Park Arboretum. HFF is fortunate to have Pat Kennar so beautifully document this project on film. HFF continues to receive good comments on this fern display garden. Numerous handouts on ferns such as; recommended ferns for N.W. gardens, ferns for specific sites, a source list, genus characteristics, culture, propagation and last but not least, HFF membership brochures were made available. Thanks to HFF board members and friends for manning the booth during the five day run of the show.

This year's Fern Festival will be held on June second and third at the Center for Urban Horticulture at the University of Washington. This two day event is the fern enthusiast's quest for Nirvana in this lifetime. HFF is very fortunate to be able to have Robbin Moran as our featured speaker. Robbin is Curator of Ferns at the New York Botanical Garden, is the co-author of *The Fern Manual* and author of the recently published *The Natural History of Ferns*. Numerous fern species and varieties will be available for sale, including a large number of specimen plants. A workshop on fern propagation by spore will be given and fern experts will be on hand to help identify and answer all manner of questions concerning ferns. This is HFF's yearly gala event, sale and fund raiser.

Last month the HFF Board attended an all day work shop on the future development of a new and expanded web site. Good progress was made in determining what the web site should include, getting this outlined and prioritized. A review of current web sites of similar plant organizations was conducted and were scrutinized for features that make a site pleasing to look at, user friendly, functional in design, scope, flexible, etc. A web designer will be hired to implement the requirements recommended by the HFF board.

Plans will soon be made for the installation of a fern stumpery at the Rhododendron Species Botanical Garden that houses the HFF main study garden and growing facilities in Federal Way, Washington. We hope that we can do this project this summer. The staff of the RSBG have already cleared the wonderful large site for installation. I know not of any fern stumperies in the Pacific Northwest other than the natural ones we see in undisturbed old growth sites of the Hoh, Quinault and Queets valleys in the Olympic National Park. This unique landscape feature will certainly add interest on how ferns can be displayed in a natural and dramatic style.

Last week Michelle Bundy, Jo Laskowski and I took a trip down to Russell Graham's Nursery near Salem, Oregon to pick up large specimen ferns that will be available for purchase at the upcoming fern festival. Board member Jeanie Taylor met us at the nursery shortly after we arrived in late morning. Russell joined us for a walk through the nursery. The cold spell in February browned out a number ferns, in particular the dwarf deer fern, *Blechnum penna-marina*. Burnt brown leaf margins were evident on the scores of hellebores that Russell grows, but they were in full bloom, the flowers glorious. The rectangular beds of the nursery march up a thinned woodland slope of predominantly Douglas Fir, *Pseudotsuga menziesii* and Garry Oak, *Quercus garryana*. Beds of ferns, hellebores, epimediums, geraniums, and other woodlanders were randomly arranged down the full length of the slope, with tags standing at the ends of beds revealing the name of its occupants. A beautiful sight. We drove through the rural landscape of the central Willamette Valley and after a circuitous route stopped in the small town of Amity. After a late lunch at the local and only café we went to the grade school where the community was hosting their Daffodil Festival. In the gym were long tables with numerous daffodil flowers in narrow glass tubes beautifully arranged in groups such as Giant Trumpets, Large Cupped, Small Cupped, Singles, Doubles, Ruffled – Single or Double, Miniatures, Split Crown, Jonquils, Cyclamineous, etc. and my favorite, Unknowns. The diversity in the flower morphology and color is remarkable. Outside the gym was the plant sale area in which a number of local nurseries were selling plants of all kinds, many interesting new cultivars and varieties that I was seeing for the first time. Heading north we stopped off at Jeanie Taylor's place near McMinnville. Jeanie's family recently bought this twenty acre place for a get away and possible future retirement place. Jeanie wants to restore the landscape to its original Oak/Savanna plant community that was evident before the arrival of western settlers in the 1800's. This plant community was maintained by Native Americans by selective yearly burning that discouraged the encroachment of Douglas Fir, *Pseudotsuga menziesii* and its associated shade tolerant understory plants resulting in a more open landscape of Garry Oak, *Quercus garryana* and grasses. As we began our walk through the property the path led us by a small pond. The path and surrounding slope were covered by hundreds of slowly moving rough skinned newts that were moving in the direction of the recently drained pond. These dark brown, shiny and mucus covered amphibians seemed set on an undeterred mission all moving in one direction only stopping in a frozen stance as we walked near them obviously, alerted by the vibration our foots steps. It was an unexpected and unusual sight not soon to be forgotten. The evening darkness was setting in over Gopher Valley as we got into the vehicle for the long drive back to Washington.

*May this message find you in good health and spirits. Happy fern gardening.*

Best regards,

*John van den Meerendonk*



# On The Beauty of Ferns, The Psychology of Pteridophilia

*Alan Ogden - Alvechurch, England*

Everyone must have taken a child for a walk and come home with a collection of things which have been discovered along the way. A pretty flower, a feather, a pine cone and if the walk has been beside the sea a collection of shells. They may have been kept for a while to decorate a window sill or mantelpiece or treasured in a small box; this is an experience familiar to us all.

Have you ever asked yourself what it is about these objects which makes them attractive, to make one want to pick them up and to keep them as though they are valuable? The answer is in the fascination of their shape, the simple complexity, the appeal to the eye, the sheer extravagance by which such a masterpiece of design is discarded so casually by nature.

A modern development in mathematics, connected with the use of computers, has gone some way towards explaining these shapes. They are called fractals; it was found that the constant reiteration of a geometric shape would create the most beautiful and fascinating designs and the shapes of the items in the child's collection could be created mathematically.

Take a closer look at a snail's shell, it forms a helix which gradually expands. A pine cone is also built on a helical pattern and a flower, if it is more than a simple structure is also spirally built. Take a look at the seeds in a sunflower centre if you don't believe me.

It is possible to make a very passable representation of the frond of a fern by fractals too and the lovely spiral, the fiddlehead of a new frond unfurling is a mathematical masterpiece. So it is mathematics which give it its appeal to the eye.

The ancient Greeks knew a thing or two about beauty. Their artistry in sculpture and painting is still being copied today and the perfect proportions of their buildings are echoed in such diverse structures as the radiator of Rolls Royce cars and the front of The White House. The Greeks applied mathematics to the creation of beauty, they described the "golden section" - the division of a line into two so that the ratio of the whole line to the larger part is the same as the ratio of the large part to the smaller part. Why this is aesthetically pleasing no-one knows, it just is.

The columns of a Greek temple are not cylindrical - they swell gently in the lower third, called entasis. Without this they don't look right. This cannot be a function of the eye which records like a camera. It is something to do with our brains and the way we unconsciously interpret what we see.

So the shape of a fern, the familiar crown or shuttlecock, is beautiful because it is mathematical perfection and to bear this out there are other similarly shaped objects which we find lovely too - the contours of a vase, the form of a fountain of water and emblems like the fleur-de-lys.



Then, to compound the attraction, there is another feature of many ferns which we find irresistible and that is the subdivision of the frond into tiny leaflets. The frond shapes are fractals too and in addition there is something which fascinates us about things which are visually complicated. Think of lace, think of filigree, think of mosaics.

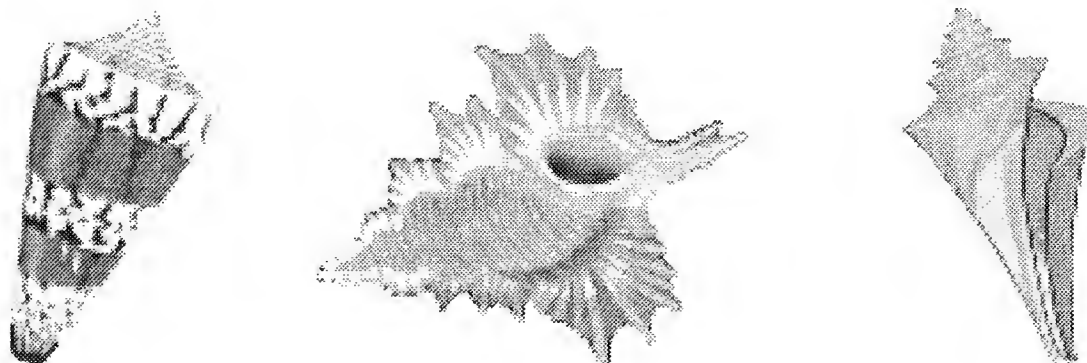
The added attributes of ferns are that they are alive, they are cool and aloof and they are mysterious. Most people know that ferns have been around for a long time but exactly how long is difficult to imagine. It was not the ferns we have today which helped to form the coal measures but it was something very similar. This was long before flowers were evolved.

There is something rude and intrusive about flowers - they shout "Hey, look at me!" and sometimes they have wonderful smells to increase the appeal. They are not shouting at us, of course they are appealing to insects or birds but it is their sex organs which they are waving in front of us.

Ferns are demure, they don't give a damn what we think. The large ferns we see don't have any sex organs, in fact, their method of reproduction is so discreet that it was not worked out by botanists till a couple of centuries ago. There was a belief that fernseed was invisible and if you could get some it would make you invisible too. Shakespeare has Gadshill, one of the minor characters in part 1 of Henry IV, say, "...we have the receipt of fernseed, we walk invisible."

The mysterious reproduction of ferns means that they often live in some interesting places. Cool misty forests and rainy uplands are their favoured haunts and those of us who like to seek them out prefer these places to hot sandy beaches which are a botanical desert.

We all like to be party to a secret so to learn about ferns, to be admitted to that select body of people who understand their ways is a bit like joining the Magic Circle and to know ferns, to have them live and flourish in the garden is a joy which is difficult to express but it is one in which we can all share if we are willing to make friends with the ferns.





## The Families Huperziaceae and Lycopodiaceae of New England

Arthur Haines, 2003, V.F. Thomas Co., 219 Dead River Road,  
Bowdoin ME 04287

Reviewed by Joan Eiger Gottlieb

This is a cross between a colorfully illustrated field guide and a taxonomic treatise. It proffers two new genera and two newly named hybrids, complete with Latin descriptions. Its 9" x 11" dimensions and spiral binding make it backpack, but not back pocket, friendly. The author Arthur Haines is clearly enamored of these lycopods (by way of full disclosure, so is this reviewer) and has thoroughly pondered their long evolutionary history, their current, somewhat precarious ecological status and their taxonomic intricacies. He has notably produced all but two of the many illustrations, including habitat photos and close ups of leaves, leaf patterns and strobili (cones) that aid in resolving identification subtleties. For example, the images of the bud-like, leafy gemmae of *Huperzia appressa* (*H. appalachiana*), *H. selago* and *H. lucidula* are helpful in distinguishing these look-alike, yet distinct species.

Especially today, when evolutionary biologists, using DNA sequencing, are refining the relationships among seed plants, ferns and the so-called "fern allies," it is nice to have a fresh look at some of the lycopod "allies". Lycopods ("fir mosses" and "club mosses") are one of the oldest lineages of vascular land plants, dating back 400 million years to the Devonian period of the Paleozoic era. Haines puts them into separate families (Huperziaceae and Lycopodiaceae) and they, along with "spike mosses" (Selaginellaceae) and "quillworts" (Isoetaceae,) are all that we have left of a rich flora that once included tree size genera such as *Lepidodendron* and *Sigillaria*. These "fern allies" diverged early from a common ancestry with the true ferns and seed plants. Furthermore, they have not changed much since then except for the extinction of their arborescent relatives. "Horsetails" (Equisetaceae) and "whisk ferns" (Psilotaceae) used to be included in this assemblage, but new analysis indicates that they are part of the same line as the true ferns, evolving parallel with them.

As potential lycopod finds in New England Haines lists 18 species and several hybrids (3 in *Huperzia*, 5 in *Diphasiastrum* and 3 in *Lycopodiella*). The most controversial part of his book is the splitting of two newly proposed genera out of *Lycopodium*. They are "*Spinulum*" (formerly *L. annotinum*) and "*Dendrolycopodium*" (formerly *L. obscurum*, *L. dendroideum* and *L. hickeyi*.) This would leave only *L. clavatum* and *L. lagopus* within the genus *Lycopodium* in N. America.

The characters that Haines uses to parse these taxa are compared in the accompanying table, assembled from Haines' descriptions and some additional material from W. H. Wagner and J. Beitel's treatment in *Flora of North America*, Vol. 2, 1993. In fairness, Wagner and Beitel recognize "groups" within *Lycopodium* that conform to Haines' segregations. Taxonomic lumpers will not be pleased to see more names to juggle, especially since the distinctions cited are questionably worthy of new generic ranking.



Certainly, if one considers gametophyte characteristics (as Beitel urged in the Sept., 1979 *Fiddlehead Forum*), the commonality of a flat, irregularly disc-shaped gametophyte with a circumferential, ring meristem and an underground, non-green, fungus-dependent growth habit unites the North American lycopodiums and separates them from all other genera. Gametophyte characters tend to be strongly conserved in evolution since the sexual success of the species depends on them and even minor mutations are apt to disturb, rather than improve finely tuned, efficiently operating systems (the “monkey wrench” principle). Most mutations are damaging; that is why we fear them. But, mutations are not equal in their effect on species. For example, a simple mutational change in the chemistry of the archegonial neck may reduce the likelihood of the sperm finding and fertilizing the egg, with serious survival implications. On the other hand, mutations that eliminate the hair tips on sporophyte leaves or alter the arrangement of leaves around the stem are far more benign and may actually increase diversity within species – potentially a good thing for adaptation and survival in an ever-changing world.




Haines defends his “splitting” as necessary to “create a consistent nomenclature system in which all of the discrete lycopod groups are provided with the same rank.” He claims that the distinctive morphological features of “*Dendrolycopodium*” and “*Spinulum*” are equal in importance to those that led to the now accepted separation of *Diphasiastrum* and *Lycopodiella* from the formerly inclusive genus *Lycopodium*. However, *Diphasiastrum* gametophytes are carrot-shaped, subterranean “tubers”; those of *Lycopodiella* are photosynthetic, surficial “pin cushions”. Both are very different from the button or disc-shaped, underground sexual plants of *Lycopodium*. Add in their distinctive sporophyte features and the taxonomic elevation of *Diphasiastrum* and *Lycopodiella* to separate generic status appears to rest on a more solid foundation than would “*Dendrolycopodium*” or “*Spinulum*” whose gametophytes are virtually indistinguishable from those of *Lycopodium*. In addition, Haines elevates *Huperzia* (and related genera outside New England) to new Family status – Huperziaceae. In *Flora of North America* the family Lycopodiaceae is a single umbrella for both the “fir mosses” and the “club mosses”. I can recall a time when the genus *Huperzia* did not exist and its member species were included in *Lycopodium*. Splitting is, indeed, a slippery slope. Someone starts it and, all too soon, others want to get in on the action.

Haines deserves praise for the “equal time” given to the lycopod hybrids. These are usually ignored or relegated to brief mentions in most books. In *Huperzia*, *Diphasiastrum* and *Lycopodiella* promiscuity is rampant and many inter-specific hybrids are known; some are even common. I was fortunate enough to recognize and name the first of these lycopod hybrids back in 1956 (*Lycopodiella* x *copelandii*, a blend of *L. alopecuroides* and *L. appressa*). Only the genus *Lycopodium* has no confirmed, true hybrids. Haines offers “*Spinulum*” (*Lycopodium*) *annotinum* x “*S*”. *canadense*, but the latter is regarded in *Flora of North America* as a high altitude form (*L. annotinum* var. *alpestre*), with gradations common as elevation changes.





The book is organized alphabetically, which is handy for quick reference in the field. However, that creates odd bedfellows, as when you find *Lycopodium* lying between and separating spatially the otherwise closely allied genera *Lycopodiella* and *Pseudolycopodiella* or, when the newly proposed “*Dendrolycopodium*” and “*Spinulum*” fall to opposite ends

*continued on page 36*

of the book, both quite remote from their closest relative – *Lycopodium*. It makes comparisons cumbersome. I resorted to using post-it notes as improvised tabs. Contained in Sections 9 – 11 at the end of Haines’ book there are detailed rationales for his proposed “Nomenclatural Innovations”, a helpful, pictorial synopsis of the lycopod genera in New England and a very adequate bibliography. The book will be useful throughout the northeast since most of the species also can be found in New York, New Jersey, Pennsylvania, Ohio and West Virginia. West Virginia is an amazing epicenter of lycopod abundance, including many hybrids, undoubtedly due to the acidic soils, abundant bogs and mining disturbances.

NEW ENGLAND LYCOPOD GENERA (as proposed by Arthur Haines and compared by Joan Gottlieb)			
	<i>Huperzia</i>	<i>Lycopodiella</i>	<i>Pseudolycopodiella</i>
Horizontal Stems	Absent. Decumbent uprights in some species	Prostrate or partly arching Leafy, rooting throughout. May reduce to thick tip in winter	Prostrate, flattened to surface and tightly anchored by roots Short-creeping; evergreen
Upright Stems	Determinate (dies in 2-4 yrs) or indeterminate (not dying) Dichotomously (equal) branched Terete (round in cross section) Gemmae on modified branches	Unbranched and very leafy. Each shoot essentially a peduncle bearing a single strobilus	Unbranched; sparsely leafy Each shoot essentially a peduncle bearing a single strobilus
Sterile Leaves (trophophylls)	Not in discernible ranks Monomorphic but varying in size seasonally	Isophyllous and mostly monomorphic Entire or toothed	Dimorphic; longer laterals and shorter, ascending medians on creeping stems. Tiny, appressed and widely spaced on uprights.
Reproductive Leaves (sporophylls and strobili)	Strobili absent; sporangia in axils of ordinary leaves, forming annual fertile zones	Strobilus leaves isophyllous, longer than shoot leaves, green	Strobilus lvs. tightly appressed, shorter than shoot leaves and straw colored
Sporangia and Spores	Sporangia reniform (kidney like) Spores pitted or grooved	Sporangia nearly globose Spores rugulate (wrinkled)	Sporangia globose Spores rugulate
Habitat and Range	Shaded woods to cliff faces Temperate, alpine, arctic regions and mountains of tropical Asia	Moist acidic soils, bogs, pits. Mainly on coastal plain of north temp. region and tropical Amer.	Wet, sandy or peaty soils Coastal plain worldwide
Gamteophytes	Non-green; fungus dependent Subterranean; linear to elliptic Ring meristem absent	Green and photosynthetic Pincushion shaped on wet, acidic surfaces. No ring meristem.	Green and photosynthetic Lobed/tuberous on wet, acidic surfaces. No ring meristem.
Chromosome Number	N = 67	N = 78	N = 35
Hybrids	<i>H.X. buttersii</i> ( <i>lucidula</i> x <i>selago</i> ) <i>H.X josephbeitelii</i> ( <i>apperssa</i> x <i>selago</i> ) <i>H.X protophorophila</i> ( <i>appressa</i> x <i>lucidula</i> )	<i>L.X copelandii</i> ( <i>alopecuroides</i> x <i>appressa</i> ) <i>L.Xrobusta</i> ( <i>alopecuroides</i> x <i>inundata</i> ) <i>L. appressa</i> x <i>inundata</i>	A sterile triploid is known from crosses between 2N x 4N forms
New England species	<i>H. appressa</i> (= <i>H. appalachiana</i> ) <i>H. ludicula</i> <i>H. selago</i>	<i>L. alopecuroides</i> <i>L. appressa</i> <i>L. inundata</i>	<i>P. caroliniana</i>
Outline Sketch	 <i>Huperzia lucidula</i>	 <i>Lycopodiella inundata</i>	 <i>Pseudolycopodiella caroliniana</i>
Illustrations adapted from: Beitel, Joseph. "Clubmosses ( <i>Lycopodium</i> ) in North America," <i>Fiddlehead Forum</i> Vol. 6 – No. 5. September-October, 1979.			

Despite the questionable taxonomic tweaking in this book (or maybe because of it), I yearn to return to the field to hunt for these unique, mysterious and elegant little plants – too often overlooked by the casual plant lover. When surrounded by a Lilliputian forest of *Lycopodium* or its siblings I am transported back in time 300 million years or more to the “Age of Pteridophyta” (the Carboniferous period of the Paleozoic), when arborescent relatives of today’s little groundcover gems dominated the swampy landscape, then left us their compacted remains as coal. Thank you, Arthur Haines, for creating some new curiosity and controversy that may compel others to study and conserve the extant members of this ancient flora.

NEW ENGLAND LYCOPOD GENERA (as proposed by Arthur Haines and compared by Joan Gottlieb)			
<i>Diphasiastrum</i>	<i>Dendrolycopodium</i>	<i>Lycopodium</i>	<i>Spinulum</i>
Surface growing or shallowly buried; long creeping	Subterranean, long-creeping Non-green	Surface growing, long-creeping. Green	Surface growing, compact-creeping Pale green
Branched; branchlets flat in cross section (round in <i>D. sitchense</i> ) Annual constrictions absent or inconspicuous	Tree-like; rounded main axis with repeatedly forked branches Annual constrictions absent or weak	Clustered along creeping stem. Round in cross section. Branched; annual constrictions conspicuous	Clustered, branched or unbranched; round cross section Annual bud constrictions conspicuous on main uprights
Appressed to ascending on horiz. stems; di-to trimorphic 4-ranked and appressed except in <i>D. sitchense</i> (spreading, 5-r) Deep green	Appressed, ascending, spreading depending on position/species Needle-like; isophyllous; in 6 ranks Deep green	Isophyllous, spreading/ascending. Tipped with a narrow, pale hair Medium green	Isophyllous, sharp-tipped Spreading to reflexed; margins slightly toothed along tip half Dark green
Strobili multiple; leafy peduncles (solitary, sessile - <i>D. sitchense</i> ) Strob. lvs. deltate, straw colored	Strobili multiple; sessile on upright branch tips Strobilus leaves straw colored	Strobili single to several; straw colored, scale-like-lvs. Peduncles pale, sparsely foliated	Strobili single, sessile on upright shoots. Strobilus leaves straw colored, abruptly narrow at tip.
Sporangia reniform Spores reticulate	same as <i>Lycopodium</i>	Sporangia reniform Spores reticulate	same as <i>Lycopodium</i>
Acidic soils in deciduous and coniferous woods Temperate and sub-arctic	same as <i>Lycopodium</i>	Bog edges, borrow pits. open deciduous/coniferous woods. Temperate to sub-arctic	same as <i>Lycopodium</i>
Non-green; fungus dependent Subterranean; carrot shaped Ring meristem present	same as <i>Lycopodium</i>	Non-green; fungus dependent. Flat, irregular, button-shaped Ring meristem present	same as <i>Lycopodium</i>
N = 23	same as <i>Lycopodium</i>	N = 34	same as <i>Lycopodium</i>
<i>D. Xzeilleri</i> (compl x tristachyum) <i>D. Xhabereri</i> (digit x tristachyum) <i>D. Xissleri</i> (alpinum x compl.) <i>D. Xsabinifolium</i> (stitch. x tristach.) <i>D. complanatum</i> x <i>digitatum</i>	same as <i>Lycopodium</i>	None Known	Same as <i>Lycopodium</i>
<i>D. complanatum</i> <i>D. digitatum</i> <i>D. sitchense</i> <i>D. tristachyum</i>	<i>D. obscurum</i> <i>D. dendroideum</i> <i>D. hickeyi</i>	<i>L. clavatum</i> <i>L. lagopus</i>	<i>S. annotinum</i> <i>S. canadense</i> (? Probably an elevational variant of <i>S. annotinum</i> )
<div>     </div> <div> <i>Diphasiastrum digitatum</i>    <i>Dendrolycopodium obscurum</i>    <i>Lycopodium clavatum</i>    <i>Spinulum annotinum</i> </div>			

# *Fern Festival 2006*

Our annual festival will take place on

**June 2nd**

*with a plant sale from 1:00 to 6:00  
and an evening meeting and continuing sale at 6:30.*

*The evening program will feature a lecture at 7:30 on*

## **“Helpful and Harmful Ferns”**

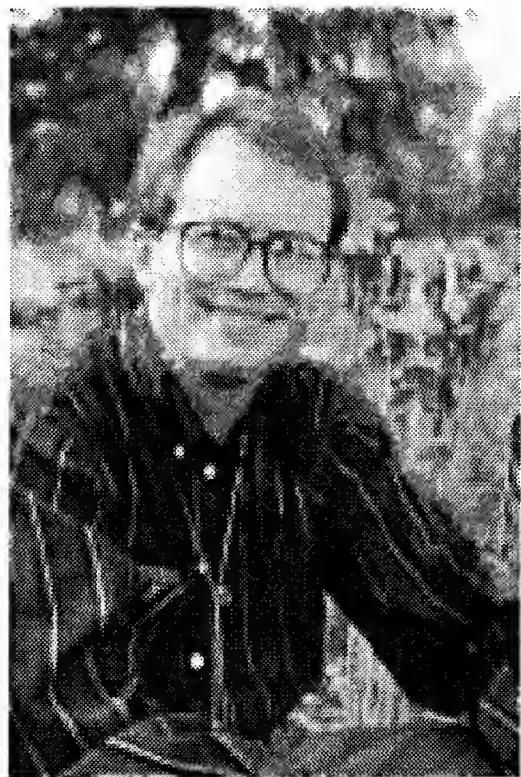
by Robbin Moran, Curator of Ferns  
at the New York Botanical Garden

*The sale will continue on June 3rd from 10:00 to 2:00  
with a propagation workshop at 11:00.*

The sale features an outstanding selection  
of ferns and companion plants.

Experts will be on hand to answer questions and help with selections.

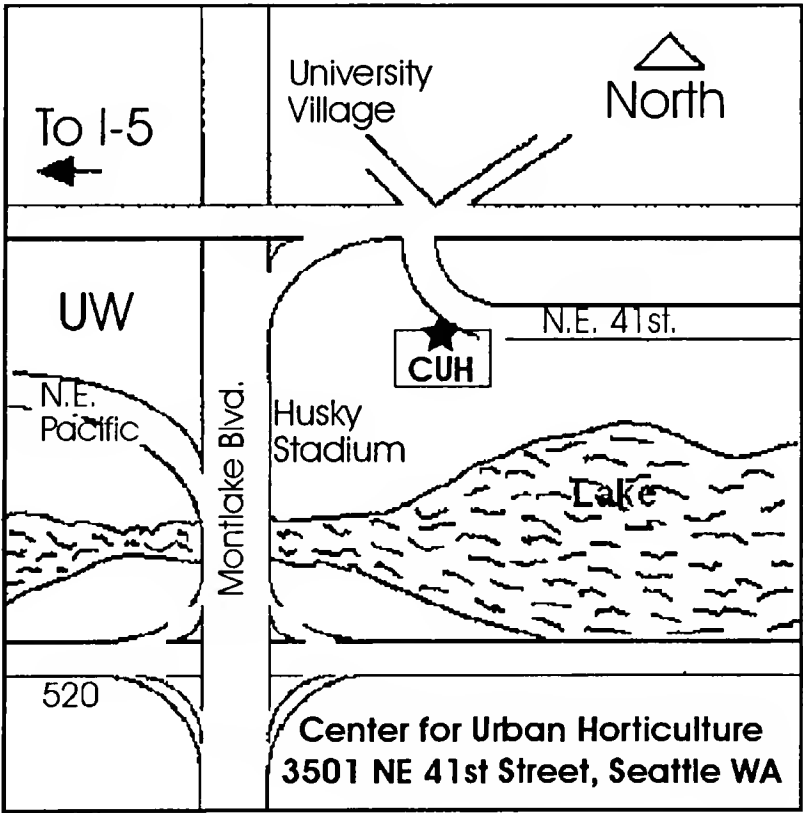
*The Festival will be at the*  
Center for Urban Horticulture, 3501 NE 41st St.  
Seattle, WA



**Dr. Robbin Moran** is Curator of Ferns at The New York Botanical Garden. He has published four books and over 70 papers on ferns. He served as the main writer, editor, and organizer for the fern volume of *Flora Mesoamericana*, which is the largest fern flora ever written. Robbin has taught fern courses in Costa Rica, Venezuela, Ecuador, and Bolivia, and traveled widely in Latin America, Thailand, and Taiwan. During summers he co-teaches *Tropical Plant Systematics*, a six-week long course in Costa Rica sponsored by the Organization for Tropical Studies. He also serves as an Associate Editor for *Brittonia* and the *American Fern Journal*, and is a card-carrying member of the New York Mineralogical Club. He recently published (October 2004) a new book with Timber Press, *A Natural History of Ferns*.

# Title of talk: Helpful and Harmful Ferns

**SUMMARY:** Ferns interact with people in both helpful and harmful ways. Azolla, the mosquito fern, is the world's most important fern economically because it is used as a fertilizer in the rice paddies of southern China and Vietnam. Several ferns are eaten in the fiddlehead stage, while the young leaf is unfurling. Ostrich fern fiddleheads are popularly eaten in eastern North America and are the largest export crop of New Brunswick, Canada. Ferns are also used in construction, such as tree fern trunks in the tropics, and for making baskets, as is done with the rachises of *Lygodium*, a climbing fern. In Vanuatu, tree fern trunks are carved into stylized figures and used in grade ceremonies marking a person's advance in society. But not all interactions of ferns and people are helpful. Bracken is the "Lucretia Borgia" of the fern world because it contains many toxins poisonous not only to people, but also to livestock and insects, causing death in diabolical ways. Eating bracken fiddleheads is associated with a high incidence of stomach cancer. *Salvinia molesta*, a floating fern, is one of the worlds worst aquatic weeds. A species of climbing fern (*Lygodium microphyllum*) smothers the ground vegetation in cypress swamps in southern Florida, and its climbing leaves carry occasional ground fires up into tree crowns. The four-leaf clover fern (*Marsilea*), called "nardoo" in Australia, is responsible for the deaths of Australia's most famous explorers.







## Sorting out the Cultivars of *Polystichum setiferum*

Alastair Wardlaw, Glasgow, Scotland

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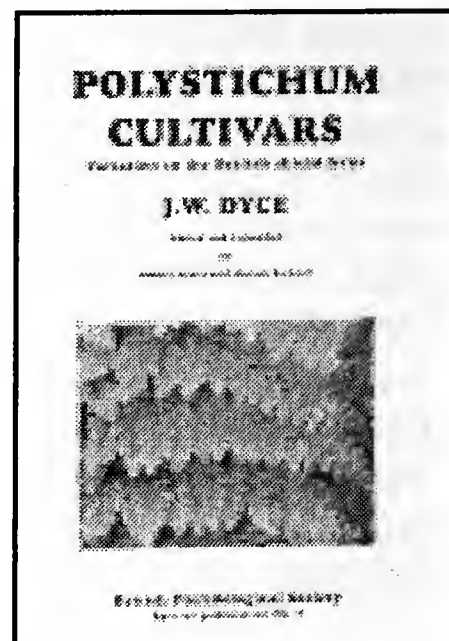
### *Polystichum Cultivars – Variation in the British Shield Ferns*

by J.W. Dyce, Eds. R.W. Sykes & M.H. Rickard (2005).

BPS Special Publication No. 7.

100 pages, £12.50 (p&p extra). ISBN 0 9509806-6-8

Orders may be placed through the BPS website: [www.ebps.org.uk](http://www.ebps.org.uk)



This is an unusual book in several respects. Firstly, it is notably posthumous, in that the author, J.W. ('Jimmy') Dyce, died in 1996. Secondly, Robert Sykes and Martin Rickard who took Dyce's outline-text through to publication were, in my opinion, excessively modest in describing themselves merely as Editors. I know this because I saw the original draft before they started to rewrite it, let alone chase up all, or most, of the illustrations. The fact that it has been published with the displayed attributions is largely due to Jimmy's ability to enthuse and inspire affection in members of the British Pteridological Society. One senses that the Editors had a constant imaginary dialogue with their deceased friend, arguing the points that needed revision, while preserving the essential outline.

The main subject of this work is *Polystichum setiferum*, the soft shield-fern, formerly known as *Polystichum angulare*. For reasons that remain obscure, this species has been particularly active in producing spontaneous varieties, sports or mutants, with cresting and other variations of the fronds. By comparison, the other two species of *Polystichum* in the British flora, *P. aculeatum* and *P. lonchitis*, have been relatively variation-free. During the Victorian fern craze of 150 years ago, when the railways opened up widespread access to the British countryside, large numbers of *P. setiferum* varieties were wild-collected and brought into cultivation. While some of these are still being propagated, many were permanently lost during the two World Wars which devastated fern collections as well as young men.

The main thrust of this 100-page book is to impose systematics on the *P. setiferum* varieties, some of which are beautiful while others are bizarre or even monstrous (in my opinion!). The Dyce System, which Sykes and Rickard have edited and refined, classifies and gives names to the several types of variation in frond architecture. For example, the Capitatum Group contain those variants with cresting or forking at the frond apex only. Whereas the Cristatum Group has variants with cresting or forking at the tips of pinnae. In



the Percristatum Group the cresting or forking is manifested at both pinna and pinnule tips. The next major criterion focuses on the branching either of the main leaf axis (Ramosum Group) or the axis of each pinna (Cruciatum Group). The Dyce System then moves on to the relative length and extent of overlap of pinnae, and the overall shape and degree of dissection of pinnules. In all, there are 32 varietal Groups, set out as a taxonomic key with primary divisions 1, 2 and 3, which in turn are subdivided as 1.1, 1.2 and 1.3, with further subdivision as 1.1.1, 1.1.2, etc. For example, the well known cultivar 'Bevis' which has sickle-shaped pinnules, is in 2.1.4 Bevis Group. There is even a further level of subdivision, to give subvarieties such as *P. setiferum* (Bevis Group) 'Drueryi' and *P. setiferum* (Bevis Group) 'Gracillimum'.

This monograph is greatly enhanced by the profuseness of illustration – 118 figures in total, essentially one for each described variant. Thus the two forms of 'Bevis' just mentioned are shown as pictures of fronds, which convey so much more than mere words. Elsewhere the fronds are depicted by b/w photographs, line drawings or photocopies. There is just one colour plate, of a Plumoso multilobum Group frond, with densely overlapping pinnae.

In contrast to the numerous variants of *P. setiferum*, *P. aculeatum* has been much less productive of mutant forms. Few of the *P. aculeatum* varieties found in Victorian times survive today, and only one is described in this book. A further complication was the discovery that some variants, such as 'Bevis' which for many years were ascribed to *P. aculeatum*, are now known from chromosome count to be mutants of *P. setiferum*. With *P. lonchitis*, the few crested and imbricate variants recorded in the old literature now no longer exist.

This book will greatly assist, indeed be necessary, for those who want to find or to confirm a cultivar name when confronted with a crested or other mutant form of *P. setiferum*. Having paired the live plant with the book description, there is the further issue of proper nomenclature, as decreed by the *International Code of Nomenclature for Cultivated Plants*. With cultivars and mutants named before 1959, it is acceptable to use Latin names such as 'Cristatum'. However, any new names after that date have to be in a modern language. The present work was little affected by this rule since most of the names go back to Victorian times.

The Dyce System should also have 'template' value for classifying the variation in other fern species, such as *Athyrium filix-femina* and *Dryopteris affinis*, which have corresponding crested, cruciate, imbricate and depauperate forms. These variations presumably reflect changes in the DNA of the developmental genes that regulate fern-frond architecture. To research this would be a task for molecular biologists for whom Dyce and his Editors have now provided a systematic base in frond morphology and its aberrations.

*Polystichum Cultivars* is a nicely-produced book, written in an informal style but within a systematic framework and with much comment and analysis. Its clear descriptions and abundant illustrations may stimulate a renewal of interest in these extraordinary experiments of Mother Nature.



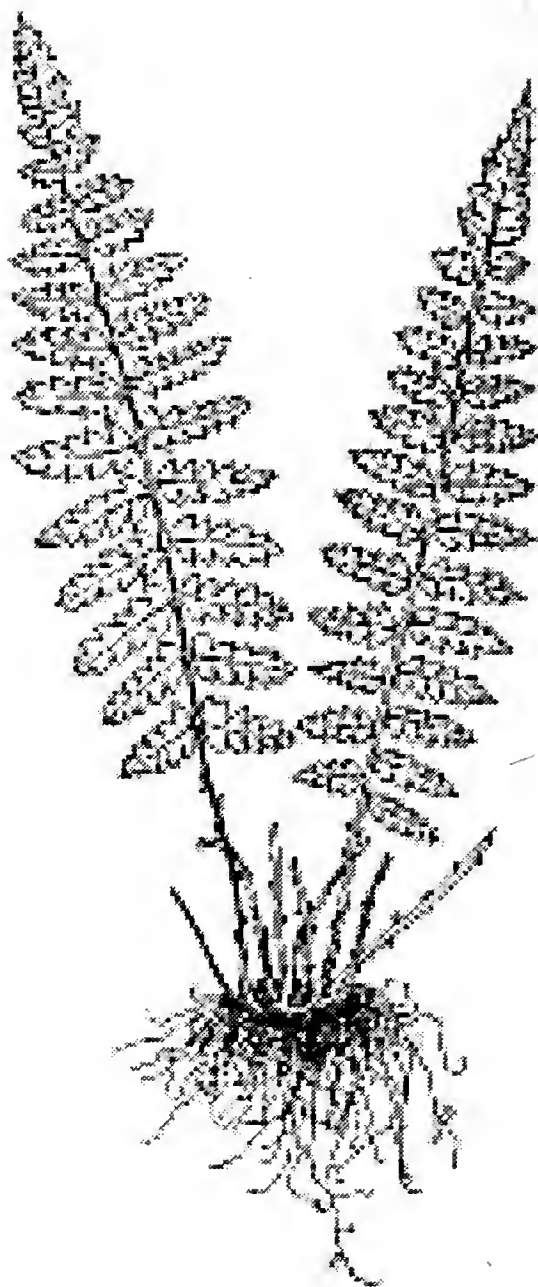
# ***Woodsia oregana***

James R. Horrocks

Salt Lake City, Utah

## **Western Cliff Fern - Oregon *Woodsia***

The genus *Woodsia* is named in honor of Joseph Woods, a late 18<sup>th</sup> century and early 19<sup>th</sup> century English botanist. The genus comprises some two dozen species mostly native to cooler regions of the northern hemisphere, but species have also been found in Central and South America and in South Africa. While some species of *Woodsia* are rarely cultivated or not cultivated at all, the species *W. oregana* responds rather well to a place in the garden. As in all other woodsias, *W. oregana* is epipetric in rock crevices, around boulders, and on ledges and talus slopes. This particular species frequents limestone or calcareous shale while other members of this genus are more prone to grow in subacid localities. In Utah, it is most common at elevations between 5000 and 9000 feet in limestone regions. It is widespread in western North America but more scattered in the east.



*W. oregana* is interesting in having two forms. Lellinger tells us: "This species contains not only diploid plants but cryptic tetraploid ones that have more globose spores and clear, enlarged cells along the segment margins... The tetraploids have been called *W. cathcartiana* or *W. oregana* var. *cathcartiana*. The nature and origin of their tetraploidy is as yet unknown and the plants are difficult to distinguish with certainty from diploid plants." The tetraploids were initially detected in eastern Minnesota and adjacent Wisconsin and thought to be restricted to that area, but recent chromosome counts indicate that the tetraploids are actually more widespread than the diploid subspecies. In fact, *W. oregana* var. *oregana* is restricted to mostly the Pacific Northwest from British Columbia down through to the northern edge of California, Nevada and barely into northwestern Utah. The tetraploid *W. oregana* var. *cathcartiana* extends from the southwestern United States through the Rocky Mountain states and from Oklahoma northward through the central states up into southeastern Canada, with a few scattered colonies in New York State and possibly elsewhere. More recently, a possible new subspecies of *W. oregana* has been discovered in the Pike's Peak area of Colorado. If so, there is speculation that the two subspecies *oregana* may be ancestral to the tetraploids (Personal communication with Dr. Michael Windham, University of Utah, April 7, 2006)

The tetraploid variety *cathcartiana* crosses with subspecies *oregana* and also with *W. neo mexicana* to produce sterile tetraploids of intermediate form. Var. *cathcartiana* also crosses with *W. obtusa* var. *obtusa* to produce *W. x kansana*. F. S. Wagner has shown that var. *cathcartiana*, not *W. scopulina*, hybridizes with *W. ilvensis* to form the sterile tetraploid *W. x abbeae*. Adding to the confusion, var. *cathcartiana* may possibly be one of the parents with *W. scopulina* subspecies *laurentiana* to form *W. x maxonii* but further testing is needed to confirm this.

Woodsias may be confused with the genus *Cystopteris* but Flowers comments that in the woodsias "the leaves are usually thicker, opaque green with the veins obscure or not distinct". In *Cystopteris* the leaves are thinner and more transparent with veins that stand out distinctly. Also, in the woodsias, there is a persistent stubble of old stipe bases, while they are not present in *cystopteris*. They differ in indusium form but in very young or very mature plants, the characteristics of the indusia and sori may be difficult to make out.

**Description:** The rhizome is short-creeping, stout, and clothed with narrow light brown scales, producing fronds in tufts. The stipes are not articulate, that is with joints, therefore the fronds break off unevenly. In some species such as *W. ilvensis*, the stipes break off evenly at a joint. In *W. oregana*, the stipes are yellowish or straw-colored and darker at the base, bearing concolorous light brown scales or sometimes irregular bicolorous scales with light brown margins and dark, reddish-brown centers. The entire frond may be from 5 to nearly 10 inches long and about 1 to 1.5 inches wide, lanceolate or oblong-lanceolate in outline, and tapering at both ends to a truncate base and an acute apex. The fronds are bipinnate-pinnatifid with 10 to 14 pairs of pinnae attached at uniformly increasing distances from the frond apex to the base. The fronds are minutely glandular, grading to glabrous, that is, lacking glands, hairs or scales. The pinnules are close, blunt, and have somewhat reflexed rounded lobes. The small indusia, bearing conspicuous marginal hairs, resemble chains of tiny beads about the same length as the mass of sporangia.

**Culture:** This little fern is certainly at home in the garden if given medium light and a cool root run. Being a rock fern, it is best grown among rocks or between rocks. It takes to alkaline conditions more so than other woodsias and is very cold hardy. The author attempted this species as well as *W. scopulina* many years ago, but both seemed short-lived in the hot valley garden. Woodsias generally need a cooler locale in order to be at their best.

## References:

*The Fern Guide* (1961) Edgar T Wherry, Double Day, New York

*A Field Manual of the Ferns and Fern Allies of the United States and Canada* (1985) David B. Lellinger, Smithsonian Institute Press, Washington D. C.

*Fern Grower's Manual* (2001 -revised) Barbara Joe Hoshizaki and Robbin C. Moran, Timber Press, Portland

*Ferns of Utah* (1944) Seville Flowers, University of Utah, Salt Lake City

# **Garden Evaluations**

Hardy Fern Evaluation Form

Date: August 21, 2005

**Garden Name: Birmingham Botanical Gardens**

**USDA zone: 7b**

Genus, Species, Variety or Cultivar	Year Planted	# of Ferns Alive	Average Fron Length (in.)	Ornamental rating 1 - 5 (5 being the best)	Ease of cultivation 1-5 (5 being the best)
<i>Adiantum aleuticum</i> 'Subpumilum'	2004	2	3	3	3
<b>Comments:</b> Excellent miniature but fronds have deteriorated during <u>daily</u> rains in past 2 weeks.					
<i>Adiantum venustum</i>	2004	3	9	5	4
<b>Comments:</b> Spreads nicely and forms a good "soft" ground cover.					
<i>Asplenium adulterinum</i>	2003	0			
<b>Comments:</b>					
<i>Asplenium ebenoides</i>	2002	0			
<b>Comments:</b>					
<i>Athyrium niponicum</i> 'Branford Beauty'	2001	3	5	2	2
<b>Comments:</b> Has been a disappointing performer in our garden.					
<i>Athyrium vidalii</i>	2003	1	13	3	4
<b>Comments:</b> Not vigorous but is increasing in size.					
<i>Blechnum chilense</i>	2004	3	7	3	3
<b>Comments:</b> Shows more promise than other <i>Blechnums</i> trialed at BBG.					
<i>Doodia media</i>	2001	NA			
<b>Comments:</b>					
<i>Dryopteris bissetiana</i>	2004	3	10	4	4
<b>Comments:</b>					
<i>Dryopteris clintoniana</i>	2002	3	20	4	5
<b>Comments:</b>					
<i>Dryopteris cycadina</i>	2002	3	22	5	5
<b>Comments:</b> Very hardy grower.					
<i>Dryopteris filix-mas</i> 'Crispatissima'	2001	3	10	3	3
<b>Comments:</b>					
<i>Dryopteris indusiata</i>	2002	1	26	5	5
<b>Comments:</b>					
<i>Dryopteris pseudo-filix-mas</i>	2002	3	29	5	5
<b>Comments:</b> A superb species that improves garden worthiness every year.					
<i>Dryopteris scottii</i>	2001	0			
<b>Comments:</b> Hot, humid months proved too challenging.					
<i>Dryopteris tokyoensis</i>	2003	3	17	5	5
<b>Comments:</b> Has been very easy to grow.					
<i>Onoclea sensibilis</i>	2004	NA			
<b>Comments:</b> Did not obtain through HFF since it grows prolifically (weedy) in Birmingham area.					

# **Garden Evaluations**

<i>Polypodium scolieri</i>	2001	0			
<b>Comments:</b>					
<i>Polypodium vulgare</i>	2003	1	3.5	1	1
<b>Comments:</b> Heat intolerant and weak growing. 'Uulong' selection has proven more vigorous.					
<i>Polystichum aculeatum</i>	2001	3	12	5	4
<b>Comments:</b>					
<i>Polystichum luctuosum</i>	2002	2	15	5	4
<b>Comments:</b> Fronds are intriguing blue-green hue. Very nice addition to garden.					
<i>Polystichum neolobatum</i>	2002	2	22	5	5
<b>Comments:</b> One of better polystichums for our area.					
<i>Polystichum piceopaleaceum</i>	2003	1	9	1	1
<b>Comments:</b> Weak and declining. Additional Genera, Species, Variety or Cultivar.					
<i>Athyrium otophorum</i>	1994	2	10	4	3
<b>Comments:</b> If sited perfectly, does well. Otherwise, heat diminishes its garden worthiness.					
<i>Cyrtomium falcatum</i> 'Rochfordianum'	1998	5	26	5	5
<b>Comments:</b>					
<i>Cyrtomium fortunei</i>	1998	5	20	5	5
<b>Comments:</b>					
<i>Dryopteris affinis</i>	1996	3	20	5	5
<b>Comments:</b> One of best; trouble-free and tolerant of different sites.					
<i>Dryopteris affinis</i> 'Azorica'	1998	3	18	4	4
<b>Comments:</b>					
<i>Dryopteris x australis</i>	2000	3	40	5	5
<b>Comments:</b> Stalwart in garden. Very vigorous.					
<i>Dryopteris championii</i>	1996	3	14	5	5
<b>Comments:</b> If sited in good drainage and considerable light, one of best, albeit slow.					
<i>Dryopteris cristata</i>	1998	2	19	2	4
<b>Comments:</b>					
<i>Dryopteris filix-mas</i> 'Undulata Robusta'	1994	2	25	5	5
<b>Comments:</b>					
<i>Dryopteris lepidopoda</i>	1998	3	8	3	3
<b>Comments:</b>					
<i>Dryopteris pacifica</i>	2000	3	17	5	5
<b>Comments:</b> Easy, though not yet as showy as <i>D. erythrosora</i> .					
<i>Dryopteris polylepis</i>	2000	3	22	5	4
<b>Comments:</b>					
<i>Dryopteris pycnopteroides</i>	2000	3	20	5	5
<b>Comments:</b>					
<i>Dryopteris sacrosancta</i>	1995	5	23	5	5
<b>Comments:</b> Grows excellently in Birmingham.					
<i>Dryopteris stewartii</i>	1998	5	27	5	5
<b>Comments:</b> Among the very best. Vigorous, controlled growth with superb color and texture.					
<i>Dryopteris sublacera</i>	1997	3	22	4	4
<b>Comments:</b>					

# **Garden Evaluations**

Hardy Fern Evaluation Form

Date: August 21, 2005

**Garden Name: Birmingham Botanical Gardens**

**USDA zone: 7b**

Additional Genera, Species, Variety or Cultivar	Year Planted	# of Ferns Alive	Average Fron Length (in.)	Ornamental rating 1 - 5 (5 being the best)	Ease of cultivation 1-5 (5 being the best)
<i>Osmunda regalis</i> 'Purpurascens'	1994	1	22	4	5
<b>Comments:</b>					
<i>Phegopteris decursive-pinnata</i>	1994	Many	21	5	5
<b>Comments:</b> Spreads vigorously, i.e., invasive.					
<i>Polypodium interjectum</i>	1998	4	4	2	3
<b>Comments:</b> Survives, but is lacking in ornamental qualities.					
<i>Polystichum setiferum</i>	1997	3	22	5	5
<b>Comments:</b> In wetter years, fronds tend to be affected by fungi.					
<i>Polystichum setiferum</i> 'Divisilobum'	1994	1	20	3	3

**What were your growing conditions this past year, including temperature highs and lows? Are there ferns in your garden that received a low rating? If so, what would you say are the reasons? Do you have any other observations?**

As of August 21, temperatures and rainfall in 2005 have been favorable for plant growth. Those ferns that emerge from winter dormancy early were spared of late freezes that can be quite damaging some years. From the beginning of year to present, the monthly average *high* temperature was 74.7°F (compared to an average normal monthly *high* of 75.13°F) and the monthly average *low* was 52.5°F compared to a normal *low* of 54.9°F).

Rainfall has been frequent and above average. The Lawn-and-Garden Moisture Index for the BBGarden as of August 6 was +2.5 inches. This index considers amount of precipitation during previous 21 days and time of year (i.e., more moisture is needed during summer than winter to support plant growth) to provide a measurement of the capacity of current soil moisture to sustain healthy lawns and gardens [www.atmos.uah.edu/aosc/lawn\\_garden2.htm](http://www.atmos.uah.edu/aosc/lawn_garden2.htm). This positive short-term index parallels the annual total precipitation to date of +4.09 inches or 110% of normal. Those ferns that enjoy an abundance of moisture exhibit a more robust habit this year than typical for late summer in Birmingham. However, some, such as *Polystichum* spp., that prefer drier soils and dislike frequently wetted foliage have declined in appearance due to foliage diseases.

**Garden name:** Birmingham Botanical Gardens

**Completed by:** Karen and Dan Jones

**Date:** August 21, 2005



# **Garden Evaluations**

Hardy Fern Evaluation Form

Date: September 9, 2005

**Garden Name: Coastal Maine    USDA zone: 4, 5**

Genus, Species, Variety or Cultivar	Year Planted	# of Ferns Alive	Average Frond Length (in.)	Ornamental rating 1 - 5 (5 being the best)	Ease of cultivation 1-5 (5 being the best)
<i>Adiantum aleuticum</i> <b>Comments:</b> Very successful	1999	3	26	5	5
<i>Adiantum aleuticum</i> <b>Comments:</b> Very successful	2002	3	28	5	5
<i>Adiantum aleuticum</i> 'Subpumilum' <b>Comments:</b> Spore, doing well	2004	3	3	5	5
<i>Adiantum venustum</i> <b>Comments:</b> No spore, 2 o.k., 1 struggling	2004	3	4	2	1
<i>Asplenium adulterinum</i> <b>Comments:</b>	2003	2	1.5	1	3
<i>Asplenium ebenoides</i> <b>Comments:</b> Both plants barely alive, very small	2002	2	1.5	1	1
<i>Asplenium trichomanes</i> <b>Comments:</b> Only one plant survived '03-'04, and it died	2001	0			
<i>Athyrium filix-femina</i> 'Frizelliae' <b>Comments:</b> Struggling, no spore	1999	2 of 3	5	3	3
<i>Athyrium niponicum</i> 'Branford Beauty' <b>Comments:</b> Spore, doing well	2001	3	21	5	5
<i>Athyrium niponicum</i> 'Pictum' <b>Comments:</b> Thriving, spore	1996	3	12	5	5
<i>Athyrium vidalii</i> <b>Comments:</b> Three fronds only, no spore	2003	1 of 3		1	1
<i>Dryopteris bissetiana</i> <b>Comments:</b> O.K., spore	2004	3	10	3	3
<i>Dryopteris x australis</i> <b>Comments:</b> Thriving, no spore	2000	2	32.5	5	5
<i>Dryopteris clintoniana</i> <b>Comments:</b> O.K., spore	2000	2	25	5	5
<i>Dryopteris clintoniana</i> <b>Comments:</b> One plant struggling with deformed leaves, one nearly dead, one dead	2002	2 of 3	10	5	1
<i>Dryopteris crassirhizoma</i> <b>Comments:</b> Thriving, spore (4 <sup>th</sup> plant has no spore)	2000	4	24	5	5
<i>Dryopteris cristata</i> <b>Comments:</b> O.K., spore	1999	2	18	4	4
<i>Dryopteris cycadina</i> <b>Comments:</b> The remaining plant did not survive '04-'05 winter	2002	0			

# **Garden Evaluations**

Hardy Fern Evaluation Form

Date: September 9, 2005

**Garden Name: Coastal Maine    USDA zone: 4, 5**

Additional Genera, Species, Variety or Cultivar	Year Planted	# of Ferns Alive	Average Frond Length (in.)	Ornamental rating 1 - 5 (5 being the best)	Ease of cultivation 1-5 (5 being the best)
<i>Dryopteris filix-mas</i> 'Crispatissima' <b>Comments:</b> Thriving but no spore	2001	3	13.5	5	4
<i>Dryopteris hondoensis</i> <b>Comments:</b> Struggling, no spore	2001	1	5.5	1	1
<i>Dryopteris indusiata</i> <b>Comments:</b> The remaining plant did not survive '04-'05 winter	2002	0			
<i>Dryopteris polylepis</i> <b>Comments:</b> Thriving, spore	2000	3	17	5	5
<i>Dryopteris pseudo filix-mas</i> <b>Comments:</b> Very small, struggling, no spore	2002	3	5.5	1	1
<i>Dryopteris pycnopteroides</i> <b>Comments:</b> Thriving, spore	2000	3	8	5	5
<i>Dryopteris remota</i> <b>Comments:</b> Thriving, spore	2000	3	33	5	5
<i>Dryopteris scottii</i> <b>Comments:</b> Did not survive severe winter of '03-'04	2001	0			
<i>Dryopteris tokyoensis</i> <b>Comments:</b> Did not survive severe winter of '03-'04	2003	0			
<i>Polystichum aculeatum</i> <b>Comments:</b> Spore, doing well	2001	3	9	4	4
<i>Polystichum munitum</i> <b>Comments:</b> This plant continues to do well, spore	2000	1	22	4	5
<i>Polystichum munitum</i> <b>Comments:</b> One plant struggling, the other dead	2003	1 of 2	4	3	2
<i>Polystichum neolobatum</i> <b>Comments:</b> Not doing well, no spore	2002	2 of 3	6	2	2
<i>Polystichum piceopaleaceum</i> <b>Comments:</b> Did not survive severe winter of '03-'04	2003	0			

**Growing conditions:** Snowy winter; April, May and the first part of June cold and wet; latter part of June, July and August, hot, humid, but with declining rainfall as the season progressed; first part of September warm and dry. Lowest temperature (Portland) –10 degrees F on 1/22/05; highest temperature – 91 degrees F on 8/13/05.

**Plants receiving low rating:**

*Adiantum venustum*  
*Asplenium ebenoides*  
*Asplenium trichomanes*  
*Asplenium adulterinum*

# Garden Evaluations

*Athyrium vidalii*  
*Dryopteris hondoensis*  
*Dryopteris pseudo filix-mas*  
*Polystichum neolobatum*

**Garden name:** Coastal Maine Botanical Garden  
**Completed by:** Catharine W. Guiles with the help of Sharman Prozan  
**Date:** 9/8/2005

Hardy Fern Evaluation Form
Date: August 28, 2005

**Garden Name:** Georgeson Botanical Garden    **USDA zone:**

Genus, Species, Variety or Cultivar	Year Planted	# of Ferns Alive	Average Frond Length (in.)	Ornamental rating 1 - 5 (5 being the best)	Ease of cultivation 1-5 (5 being the best)
<i>Adiantum aleuticum</i> 'Subpumilum'	2004				
Comments: Just planted 8-1-05					
<i>Adiantum venustum</i>	2004				
Comments: Just planted 8-1-05					
<i>Athyrium niponicum</i>					
'Branford Beauty'	2001	3	23	5	5
Comments: Can't believe this plant is alive AND growing vigorously! Great surprise.					
<i>Dryopteris expansa</i>	1997	10	21	5	5
Comments:					
<i>Dryopteris clintoniana</i>	2002	2	11	2	3
Comments:					
<i>Matteuccia struthiopteris</i>	1996	10	39	5	5

**What were your growing conditions this past year, including temperature highs and lows? Are there ferns in your garden that received a low rating? If so, what would you say are the reasons? Do you have any other observations?**

Last year's growing season was very hot and dry. The last spring frost was 8 May, and first fall frost was 4 September for a 119 day growing season. The amount of precipitation was 3.3 inches , far below our previous ten year average of 8.8 inches. The previous winter's low temperature was -44.4F, and our snowfall measured 51.7 inches. It was early and ample and should have provided great insulation. Nevertheless we lost a few ferns, especially our coastal native parsley fern. The summer was the warmest during the past 10 years. Overall, we had a spectacular growing season as long as one has access to irrigation.

Our challenge continues to be winter survival with our native ferns continuing to be the mainstay of local gardens. That is why it is so unusual when a beautiful ornamental fern such as Japanese lady fern 'Branford Beauty' survives and seems to be thriving! No doubt it will require snow cover for survival, but it is such a treat to have such a beautiful fern in our garden. We continue to evaluate ferns from other parts of Alaska with limited success. The greatest diversity is found along the coast, and many of these ferns are proving not to be hardy in our harsh Interior even with ample snow cover. We need to look more toward continental climates – northern Canada and Siberia for more appropriate experimental ferns.

**Garden name:** Georgeson Botanical Garden  
**Completed by:** Patricia S. Holloway  
**Date:** 8-23-05

# Garden Evaluations

Hardy Fern Evaluation Form

Date: August 31, 2005

**Garden Name:** Inniswood Metro Gardens

**USDA zone:** 5

Genus, Species, Variety or Cultivar	Year Planted	# of Ferns Alive	Average Frond Length (in.)	Ornamental rating 1 - 5 (5 being the best)	Ease of cultivation 1-5 (5 being the best)
<i>Adiantum aleuticum</i> 'Subpumilum'	2004	N/A			
Comments:					
<i>Adiantum venustum</i>	2004	N/A			
Comments:					
<i>Asplenium adulterinum</i>	2003	0			
Comments:					
<i>Asplenium ebenoides</i>	2002	N/A			
Comments:					
<i>Athyrium niponicum</i>					
'Branford Beauty'	2001	3	9"	5	4
Comments: Fronds should be taller by now?					
<i>Athyrium vidalii</i>	2003	2	17"	5	5
Comments:					
<i>Blechnum chilense</i>	2004	N/A			
Comments:					
<i>Doodia media</i>	2001	N/A			
Comments:					
<i>Dryopteris bissetiana</i>	2004	N/A			
Comments:					
<i>Dryopteris clintoniana</i>	2002	N/A			
Comments: See "Additions"					
<i>Dryopteris cycadina</i>	2002	N/A			
Comments:					
<i>Dryopteris filix-mas</i> 'Crispatissima'	2001	3	10"	5	3
Comments:					
<i>Dryopteris indusiata</i>	2002	N/A			
Comments:					
<i>Dryopteris pseudo-filix-mas</i>	2002	N/A			
Comments: See "Additions"					
<i>Dryopteris scottii</i>	2001	0			
Comments: Zone 8					
<i>Dryopteris tokyoensis</i>	2003	3	15"	5	5
Comments:					
<i>Onoclea sensibilis</i>	2004	N/A			



**Spring 2006 - 51**

# **Garden Evaluations**

Hardy Fern Evaluation Form

Date:

**Garden Name: Leonard J. Buck**

**USDA zone:**

Genus, Species, Variety or Cultivar	Year Planted	# of Ferns Alive	Average Frond Length (in.)	Ornamental rating 1 - 5 (5 being the best)	Ease of cultivation 1-5 (5 being the best)
<i>Adiantum pedatum</i>	1986	mass	17	3	4
<b>Comments:</b> Some browning of fronds due to drought injury.					
<i>Adiantum venustum</i>	2004	2	10	5	5
<b>Comments:</b> A great plant for shaded rock garden					
<i>Athyrium angustum f. rubellum</i>					
‘Lady in Red’	2003	12	35	4	5
<b>Comments:</b> Minor drought injury and insect damage.					
<i>Athyrium angustum f. rubellum</i>	1986	12	37	4	4
<i>Athyrium</i> ‘Branford Beauty’	2004	12	12	4	4
<b>Comments:</b> Some drought damage present.					
<i>Athyrium niponicum</i> ‘Pictum’	1996	mass	15	5	5
<b>Comments:</b> Quite variable in frond color					
<i>Athyrium</i> ‘Ghost’	2005	6	24	5	5
<i>Athyrium</i> ‘Apple Court’	2004	11	13	4	5
<i>Athyrium filix-femina</i> ‘Frizelliae’	2003	3	7	3	2
<b>Comments:</b> Not easy to establish, but interesting textured fronds.					
<i>Athyrium filix-femina</i> ‘Victoriae’	2004	5	16	5	4
<i>Cyrtomium fortunei</i>	2002	5	16	5	4
<i>Deparia acrostichoides</i>	1986	50	32	4	4
<i>Dryopteris affinis</i>	1996	5	28	5	5
<i>Dryopteris carthusiana</i>	2004	3	22	3	4
<b>Comments:</b> Drought injury					
<i>Dryopteris celsa</i>	1995	6	24	3	4
<b>Comments:</b> Needs moist soil to thrive					
<i>Dryopteris clintoniana</i>	2003	6	13	3	3
<b>Comments:</b> Suffered significant drought injury					
<i>Dryopteris dilatata</i> ‘Crispa Whiteside’	1997	5	20	5	4
<b>Comments:</b> Needs good moisture to look good					
<i>Dryopteris erythrosora</i>	1997	24	26	5	5
<b>Comments:</b> A great fern for edging paths					
<i>Dryopteris filix-mas</i>	1986	18	34	5	5
<b>Comments:</b> A very handsome fern and reliable grower					
<i>Dryopteris filix-mas</i> ‘Cristata’	1986	1	21	3	4
<b>Comments:</b> Not especially showy					
<i>Dryopteris filix-mas</i> ‘Linearis Polydactya’	1996	3	23	3	3
<i>Dryopteris filix-mas</i> ‘Undulata Robusta’	2003	10	23	5	4



## **Garden Evaluations**

**Comments:** Grows best in bright shade not in deep shade

<i>Dryopteris goldiana</i>	1986	7	28	3	4
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**Comments:** Significant drought injury present

<i>Dryopteris intermedia</i>	1986	3	20	5	5
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**Comments:** Grows well with minimal care

<i>Dryopteris marginalis</i>	1986	3	21	5	5
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**Comments:** A good grower and wintergreen fern

<i>Dryopteris remota</i>	2003	3	20	4	4
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<i>Matteuccia struthiopteris</i>	1986	mass	36	2	4
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<i>Onoclea sensibilis</i>	1986	mass	28	2	3
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**Comments:** Drought injury present

<i>Osmunda cinnamomea</i>	1997	12	33	5	3
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**Comments:** Needs good moist site

<i>Osmunda claytoniana</i>	1996	12	32	3	4
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**Comments:** Some drought injury present

<i>Osmunda regalis</i> var. <i>spectabilis</i>	1992	4	33	5	4
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**Comments:** Elegant and sturdy if kept moist

<i>Phyllitis scolopendrium</i> 'Cristatum'	1999	7	11	5	4
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**Comments:** Great rock garden plant for shade

<i>Polypodium virginianum</i>	1986	50	9	5	5
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**Comments:** Great rock hugging fern for shade rock garden

<i>Polystichum acrostichoides</i>	1986	mass	16	4	5
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**Comments:** Great in mass and for edging paths

<i>Polystichum acrostichoides</i> 'Cristata'	1987	1	15	3	5
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**Comments:** Not especially ornamental

<i>Polystichum braunii</i>	2004	6	12	5	4
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**Comments:** Highly ornamental evergreen fern, takes time to establish

<i>Polystichum polyblepharum</i>	1998	15	17	5	4
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**Comments:** Very handsome evergreen fern with glossy fronds and a good grower

<i>Polystichum setiferum</i> 'Herrenhausen'	2004	6	8	4	4
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<i>Thelypteris noveboracensis</i>	1986	15	14	2	3
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**Comments:** Some drought and insect damage present

<i>Thelypteris palustris</i>	1986	mass	19	3	4
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**Comments:** best in wet sites

<i>Woodsia obtusa</i>	2003	9	13	2	4
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**Comments:** Significant drought injury present

<i>Woodwardia areolata</i>	1986	50	18	4	3
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**Comments:** Best if kept moist, has a coarse texture that is not always easy to blend

# **Garden Evaluations**

Hardy Fern Evaluation Form

Date: October 26, 2005

## Rhododendron Species Garden

**USDA zone: 7b**

Genus, Species, Variety or Cultivar	Year Planted	# of Ferns Alive	Average Frond Length (in.)	Ornamental rating 1 - 5 (5 being the best)	Ease of cultivation 1-5 (5 being the best)
<i>Adiantum aleuticum</i> 'Subpumilum' Doing well in alpine garden.	1990	6	8-10"	5	5
<i>Adiantum pedatum</i>	1990	1	25"	5	5
<i>Adiantum venustum</i> Many patches, all thriving.	1990	Many	12"	5	5
<i>Adiantum viride-montanum</i>	1990	1	24"	4	3
<i>Arachnoides simplicior</i> var. <i>major</i> Very hardy here, looks nice through the winter although the rabbits love it	1990	4	20-24"	4	3
<i>Asplenium trichomanes</i> Grows easily in a variety of places	various	many	6"	5	5
<i>Asplenium trichomanes</i> 'Incisum'	1991	4	14"	4	4
<i>Athyrium otophorum</i> Looks good far into the winter, late to emerge in spring.	1990	5	18-24"	5	5
<i>Blechnum chilense</i> Does best in a full sun position with moist soil. Fronds turned black this year but will does come back.	1999	20	10-36"	5	5
<i>Blechnum niponicum</i> Beautiful pink new growth, seems to be a slow grower.	2000	9	9"	5	3.5
<i>Blechnum penna-marina</i> Easy to grow groundcover, takes full sun if given enough water.	1993	Lg. patch	12"	5	5
<i>Blechnum spicant</i>	1990	Many	36"	5	5
<i>Blechnum spicant</i> 'Serratum Rickard'	1990	4	30"	5	4
<i>Ceterach officinarum</i> Wedged between rocks in the alpine garden, does well.	2001	3	3"	5	5
<i>Cheilanthes argentea</i> Fairly newly planted, still settling in.	2004	6	3"	4	3
<i>Cheilanthes lendigera</i> Was overshadowed by a rhody and is struggling, needs to be moved.	?	1	6"	3	2
<i>Cyrptogramma crispa</i> Does very well in the alpine garden.		4	12"	5	5
<i>Cyrtomium caryotideum</i> Newly sited, they appear to possibly need more moisture. A select few doing well.	1991	9	16"	4	4
<i>Cyrtomium lonchitoides</i>	1994	8	18"	4	4
<i>Cyrtomium macrophyllum</i> Does fairly well but would probably appreciate more heat.	1990	15	18-20"	5	5
<i>Cystopteris bulbifera</i>	2004	1	9"	3	4

## **Garden Evaluations**

<i>Doodia media</i>	1999	12	8-10"	5	5
Very nice pinkish new growth, always turns black in the winter and then comes back. Very nice when looking good.					
<i>Dryopteris affinis</i>	2001	3	36+"	5	5
Very easy to grow, large impact fern.					
<i>Dryopteris bissetiana</i>	1999	3	12"	4	4
These seem to be slow growing, not sure if it's because of where they are sited.					
<i>Dryopteris blanfordii</i>	1997	7	22"	4	5
Very low, open habit. These were almost white last fall from leaf hopper damage.					
<i>Dryopteris celsa</i>	1994	3	24"	3	4
Sparse looking, may prefer a wetter site.					
<i>Dryopteris championii</i>	1990	9	16"	5	5
Beautiful fern, has finally settled in and taken off this year.					
<i>Dryopteris corleyi</i>	1999	5	14"	3	4
Place in a fairly sunny site, does well...not especially attractive.					
<i>Dryopteris cycadina</i>	1990	10	18"	5	4
Seems a bit slow in establishing but very nice looking.					
<i>Dryopteris cystolepidota</i>	1994	7	27"	5	5
Very easy to grow and entirely evergreen.					
<i>Dryopteris dilatata</i>	1990	3	18"	4	4
Easy to grow but unfortunately, loved by leaf hoppers.					
<i>Dryopteris erythrosora</i>	1990	18	16"	5	5
<i>Dryopteris erythrosora</i> 'Prolifica'	1990	3	8"	4	4
<i>Dryopteris expansa</i>		Many	36-48"	4	5
Nice northwest woodland native.					
<i>Dryopteris filix-mas</i>	1990	2	42"	5	5
Easy to grow, very large fern. Incurred some leaf hopper damage.					
<i>Dryopteris formosana</i>	1991	7	23"	5	5
Entirely evergreen, reliable and easy.					
<i>Dryopteris kashmiriana</i>	1999	7	24"	4	5
<i>Dryopteris lacera</i>	1990	12	20"	4	4
<i>Dryopteris lepidopoda</i>	1994	9	24"	5	5
Grow well, sited under large firs and cedars. Could benefit from more moisture.					
<i>Dryopteris ludoviciana</i>	1990	2	10"	3	3
Struggling, have moved these to a moister, sunnier site.					
<i>Dryopteris marginalis</i>	1999	13	12"	4	3
These do o.k. but nothing special.					
<i>Dryopteris namegatae</i>	2001	3	26"	5	4
Fully established, easy, beautiful texture to the fronds.					
<i>Dryopteris pacifica</i>	1999	9	23"	4	4
Very easy to grow, completely evergreen.					
<i>Dryopteris polylepis</i>	1990	1	23"	4	3
Very nice looking fern but fronds often seem to shrivel before entirely unfurling. This is the case every year with at least a few of the plants. They are close to the sprinkler and should be receiving enough water???					

# **Garden Evaluations**

## Rhododendron Species Garden

USDA zone: 7b

Additional Genera, Species, Variety or Cultivar	Year Planted	# of Ferns Alive	Average Frond Length (in.)	Ornamental rating 1 - 5 (5 being the best)	Ease of cultivation 1-5 (5 being the best)
<i>Dryopteris polylepis</i>	2000	12	14"	4	4
<i>Dryopteris pseudo filix-mas</i>	1990	6	28"	5	5
<i>Dryopteris pycnopteroides</i>	1992 and 1999	12	10-15"	4	4
These seem slow to establish.					
<i>Dryopteris sacrosancta</i>	1996	8	20"	4	4
Dependable but not especially interesting.					
<i>Dryopteris scottii</i>	2001	12	12"	4	2
Loved by slugs but unique and worth growing.					
<i>Dryopteris sieboldii</i>	1990 and 1997	11	30" +	5	4
Well established plants with no problems. New fronds in spring are late.					
<i>Dryopteris stewartii</i>	1998	3	20"	3	4
<i>Dryopteris sublacera</i>		3	12"	4	3
Very handsome fern but seems to be struggling.					
<i>Dryopteris tokyoensis</i>	2001	5	32"	5	5
<i>Dryopteris wallichiana</i>	1999	many	36"	5	5
Striking fern, once established there is nothing like it.					
<i>Dryopteris x australis</i>	2000	5	34"	5	5
Very happy and upright fern.					
<i>Gymnocarpium dryopteris</i>	1990	Many	8"	5	5
Good native groundcover, tends to wither toward the end of summer.					
<i>Gymnocarpium dryopteris</i> 'Plumosum'	1990	Many	8"		5
<i>Gymnocarpium oyamense</i>	1997	4 patches	12"	4	4
<i>Hypolepis punctata</i>	1996	1 patch	18"	3	4
Spreading slowing in a dryish, sunny spot. Need to try some in a moister site to see the difference.					
<i>Matteuccia struthiopteris</i>	1990	Many	26"	4	5
<i>Onoclea sensibilis</i>		Lg. Patch	32"	5	5
<i>Osmunda cinnamomea</i>	1997	Many	52"	5	5
<i>Osmunda claytoniana</i>	1990	1	14"	3	2
These seem to struggle, last planting eaten by slugs.					
<i>Osmunda regalis</i>	1996	Many	48"	5	5
<i>Phyllitis scolopendrium</i>	1990	7-10	10-23"	4	5
Some look better than others, depending on their site.					
<i>Polypodium interjectum</i>	1998	3	10-12"	4	4
Grows well within rocks in the alpine garden.					
<i>Polypodium scolieri</i>	1990	Lg. Patch	22"	5	5
Nice fern, slowly spreading.					
<i>Polystichum acrostichoides</i>	1990	5	14"	4	3
Well sited and doing exceptionally good.					

## ❧ Garden Evaluations ❧

<i>Polystichum aculeatum</i>	1990	1	18"	3	3
<i>Polystichum aculeatum</i>	2001	9	15"	3	3
Seems to be slow to establish.					
<i>Polystichum braunii</i>	1990	30	12"	5	5
<i>Polystichum californicum</i>	1991	3	12"	3	3
Struggling, has been moved three times.					
<i>Polystichum luctuosum</i>	2002	25	18"	5	4
Moved to a shadier site, should do better. Had been showing some sun burn.					
<i>Polystichum makinoi</i>	1991	9	12-24"	5	5
<i>Polystichum neolobatum</i>	1991	4	18"	5	5
Very drought tolerant and nice looking in the winter.					
<i>Polystichum piceopaleaceum</i>	2002	7	16"	4	4
<i>Polystichum polyblepharum</i>	1990	Many	12-15"	5	5
<i>Polystichum polyblepharum</i>	2001	30+	12"		5
<i>Polystichum retrosopalaeeum</i>	1990	9	24"	3	3
Always looks a bit rough.					
<i>Polystichum rigens</i>	2001	9	12"	3	3
Moved to new site, waiting to seem how they establish.					
<i>Polystichum squarrosus</i> ?	2001	2	10"	4	4
<i>Polystichum tsus-simense</i>	1990	5	20"	5	5
These always look good and grow very easily.					
<i>Polystichum x illyricum</i>	1990	1	16"	3	2
<i>Polystichum xiphophyllum</i>		3	16"	4	3
<i>Rumohra adiantiformis</i>	1999	3	3-5"	3	2
These often have a rusty look to them...if not that then the slugs have eaten them.					
<i>Woodsia intermedia</i>	2000	5	8"	5	5
Full sun site, beautiful small fern.					
<i>Woodwardia areolata</i>	1990	Many	16"	5	5
Planted around pond and has spread generously over the years.					
<i>Woodwardia fimbriata</i>	2005	20	24"	5	4
New planting.					
<i>Woodwardia unigemmata</i>	2000	3	36+"	5	5
Gorgeous new growth, very large arching fronds. Doing well but will move it to a more prominent spot.					

**What were your growing conditions this past year, including temperature highs and lows? Are there ferns in your garden that received a low rating? If so, what would you say are the reasons? Do you have any other observations?**

The first week of January 2005, we had our coldest recorded day of the year with temps dropping to 23F. During February the temperature was recorded at below freezing for most of the month. April 12<sup>th</sup> was the last freeze here at the garden. The snowpack in the mountains was unseasonably low and our spring was very mild. During the summer months we hit a high of 90F on July 18<sup>th</sup>. There was very little measurable rainfall from June through August. Leafhopper damage this season was not quite as bad as last year.

**Garden name:** Rhododendron Species Botanical Garden

**Completed by:** Michelle Bundy

**Date:** 10-26-05

# **G a r d e n   E v a l u a t i o n s**

Hardy Fern Evaluation Form

Date: October 26, 2005

**Stephen F. Austin State University**

**USDA zone:**

Genus, Species, Variety or Cultivar	Year Planted	# of Ferns Alive	Average Frond Length (in.)	Ornamental rating 1 - 5 (5 being the best)	Ease of cultivation 1-5 (5 being the best)
<i>Adiantum aleuticum</i> 'Subpumilum'	2004	0			
<i>Adiantum venustum</i>	2004	2	4	2	3
<i>Athyrium vidalii</i>	2003	1	6	1	1
<i>Blechnum chilense</i>	2004	1	4	1	1
<i>Cyrtomium caryotideum</i>	1997	1	6	2	3
<i>Cyrtomium fortunei</i>	1997	5	18-24	5	5
<i>Cyrtomium falcatum</i>	1998	5	18-24	5	5
<i>Doodia media</i>	2002	2	8-10	5	5
<i>Dryopteris bissetiana</i>	1999	1	4-6	2	3
<i>Dryopteris championii</i>	1997	1	20-24	5	5
<i>Dryopteris corleyi</i>	1999	3	8-10	3	4
<i>Dryopteris cycadina</i>	2002	2	4-6	2	3
<i>Dryopteris hondoensis</i>	2001	2	8-20	5	5
<i>Dryopteris lacera</i> affinity	1998	4	10-20	5	5
<i>Dryopteris pycnopteroides</i>	2000	1	12	2	3
<i>Dryopteris sacrosancta</i>	1997	4	12-24	5	5
<i>Dryopteris sieboldii</i>	1997	2	8-20	4	5
<i>Dryopteris stewartii</i>	2003	3	18-24	5	5



## **Garden Evaluations**

<i>Dryopteris sublacera</i>	1997	1	20-24	5	5
<i>Dryopteris x australis</i>	2002	4	16-36	5	5
<i>Polystichum aculeatum</i>	2001	1	8-10	1	3
<i>Polystichum luctuosum</i>	2002	3	8-12	5	5
<i>Polystichum neolobatum</i>	2002	1	8-10	3	4
<i>Polystichum rigens</i>	2003	2	8-10	5	5

**What were your growing conditions this past year, including temperature highs and lows? Are there ferns in your garden that received a low rating? If so, what would you say are the reasons? Do you have any other observations?**

We had a typical dry, hot summer – high 103 degrees – low 20 degrees for two days. The low ratings indicate performance dependant on more moisture than what was provided by watering system – about 1 ¼ - 1 ½ inches every 7 – 10 days.

**Garden name:**  
SFASU Fern Garden  
**Completed by:**  
Susan K. Williams  
**Date:** 10-26-05

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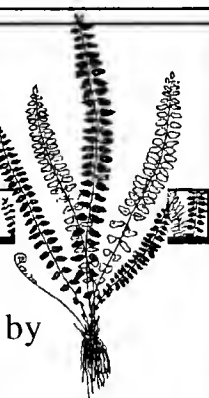
See you at the  
Fern Festival!

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### **THE HARDY FERN FOUNDATION QUARTERLY**



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**Please send your submissions to:**  
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**Please note our new address:**

P.O. Box 3797

Federal Way, Washington 98036-3797



## **New Members**

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Mary Cornell

Susan Eggers

Gary Gossett - *Terra Nova Nurseries*

Denise Hall

Chad Husby - *FIU Biological Sciences*

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# THE HARDY FERN FOUNDATION

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